* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention is suitable for the freezer provided with the inverter drive compressor and the 1 constant-speed compressor about the operating method of refrigerating cycles, such as an air conditioner. .
[0002]
[Description of the Prior Art]The thing given in JP,5-38217,B is known as an air conditioner provided with the inverter drive compressor and the 1 constant-speed compressor. The operating method of an inverter drive compressor and a 1 constant-speed compressor is as follows.
[0003](1) When air conditioning load is small, only an inverter drive compressor is operated and make drive frequency of the inverter drive compressor low.
[0004]Drive frequency is made high as air conditioning load increases. <> The drive frequency of an inverter compressor turns into maximum frequency, further, if air conditioning load increases, a 1 constant-speed compressor will also be operated and drive frequency will be lowered to lowest frequency. <> An increase of air conditioning load will raise the drive frequency of the inverter compressor again further.
[0005](2) Operating both an inverter drive compressor and a 1 constant-speed compressor, when air conditioning load is large, the drive frequency of the inverter drive compressor is high. <> Make drive frequency low as air conditioning loads decrease in number. <> Drive frequency turns into lowest frequency, further, if air conditioning loads decrease in number, a 1 constant-speed compressor will also stop and the drive frequency of an inverter compressor will be raised to maximum frequency. <> Reduction of air conditioning load will lower the drive frequency of the inverter compressor again further.
[0006]

[Problem(s) to be Solved by the Invention]While the operating method of the compressor of the above-mentioned air conditioner is operated, the inverter drive compressor is always operated and operation time becomes long substantially compared with a 1 constant-speed compressor. The drive frequency of an inverter drive compressor changes from maximum frequency to lowest frequency suddenly from lowest frequency to maximum frequency again. Therefore, the load change which an inverter drive compressor receives becomes large. <> As mentioned above, the failure rate of an inverter drive compressor has the problem of becoming large compared with a 1 constant-speed compressor.
[0007]The purpose of this invention decreases the failure rate of an inverter drive compressor, and there is in obtaining a reliable refrigerating cycle.
[0008]
[Means for Solving the Problem]A refrigerating cycle which has an inverter drive compressor made variable in drive frequency by this invention, a 1 constant-speed compressor which it set constant in drive frequency, a heat source side heat exchanger, the use side heat exchanger, and an expansion mechanism is provided with the following.
A means which changes operation of an inverter drive compressor and a 1 constant-speed compressor.
A means to stop only time which defined an inverter drive compressor beforehand when changing operation by a means to change.
A means to operate time stopped by a means to stop only with a 1 constant-speed compressor.

[0009]Here, a means which changes operation, a means to stop, and a means to operate only with a 1 constant-speed compressor mean controlling a stop of operation of an inverter drive compressor and a 1 constant-speed compressor, a start, and capability, and it is carried out by specifically forming a microcomputer etc. in an outdoor controller.
[0010]When changing operation, and only fixed time suspends an inverter drive compressor, operation time of an inverter drive compressor decreases relatively, and operation time does not become long substantially compared with operation time of a 1 constant-speed compressor. Time operated near the highest operation frequency (i.e., full rotation) can also be lessened.
[0011]A means by which this invention changes operation of an inverter drive compressor and a 1 constant-speed compressor, By a means to change, a 1 constant-speed compressor is changed to operation, and an inverter drive compressor is changed to a stop, A means for stopping which suspends an inverter drive compressor until demand frequency corresponding to request abilities to an inverter drive compressor is equivalent to a value to which only predetermined frequency becomes large from lowest frequency which drives an inverter drive

compressor when raising capability furthermore, By a means to change, a 1 constant-speed compressor is changed to operation, an inverter drive compressor is changed to a stop, and when decreasing capability further, a 1 constant-speed compressor is suspended, and only predetermined frequency is provided with a means to operate with a value which becomes small, from maximum frequency which drives an inverter drive compressor.

[0012]By suspending an inverter drive compressor until demand frequency corresponding to request abilities is equivalent to a value to which only predetermined frequency becomes large from lowest frequency which drives an inverter drive compressor when raising capability of a compressor, When a load change is smaller than a value equivalent to predetermined frequency, an inverter drive compressor can be stopped.

[0013]Frequent deactivation of an inverter drive compressor is controlled by this, and reliability can be improved.

[0014]The time when an inverter drive compressor was suspended in the above can be adapted also for a load change in the meantime enough by operating only with a 1 constant-speed compressor.

[0015]

[Embodiment of the Invention]An embodiment of the invention is described using drawing 1 thru/or drawing 4. Drawing 4 is a time chart figure showing the control method of the block diagram in which drawing 1 shows the composition of a refrigerating cycle, the line graph with which drawing 2 explains the capability of a compressor to request abilities, and the compressor with which drawing 3 is used for the refrigerating cycle by this invention, and a time chart figure showing the control method of a compressor similarly.

[0016]Two sets of the exterior unit 100 and the interior units 200 and 300 are connected by the gas piping 121 and the liquid piping 122. The exterior unit 100 comprises the compressor 105, the four-way valve 106, the outdoor heat exchanger 101, the outdoor refrigerant flow rate regulating valve 102, the outdoor fan 103, the accumulator 104, the receiver 106, and the outdoor controller 151.

[0017]The compressor 105 is provided with two, the inverter compressor 105a which motor rotation frequency changes, and the 1 constant-speed compressor 105b with constant motor rotation frequency. The outdoor controller 151 controls the number of rotations of turning on and off (operation and stop) of the inverter compressor 105a and the 1 constant-speed compressor 105b, and the motor of the inverter compressor 105a, and the valve opening of the outdoor refrigerant flow rate regulating valve 102.

[0018]The interior unit 200 comprises the indoor heat exchanger 201, the indoor refrigerant flow rate regulating valve 202, the indoor fan 203, the thermometric element 204 that detects suction air temperature, and the indoor controller 208. The signal of the thermometric element 204 is inputted into the indoor controller 208, and the indoor controller 208 is controlling the

opening of the indoor refrigerant flow rate regulating valve 202.

[0019]The interior unit 300 comprises the indoor heat exchanger 301, the indoor refrigerant flow rate regulating valve 302, the indoor fan 303, the thermometric element 304 that detects suction air temperature, and the indoor controller 308. The signal of the thermometric element 304 is inputted into the indoor controller 308, and the indoor controller 308 is controlling the opening of the indoor refrigerant flow rate regulating valve 302. <> The indoor controllers 208 and 308 and the outdoor controller 151 are connected by the transmission line 123.

[0020]The flow of the refrigerant at the time of cooling operation is explained. The solid line arrow shown in the gas piping 121 and 122 copies of liquid piping expresses a refrigerant flow direction, and the solid line arrow in the interior unit 200 and 300 shows the flow direction of air.

[0021]The refrigerant breathed out from the compressor 105 passes along the four-way valve 106, and goes into the outdoor heat exchanger 101, and heat exchange is carried out to the outdoor air sent with the outdoor fan 103, and it is condensed. Then, the condensed refrigerant goes into the receiver 107 through the outdoor refrigerant flow rate regulating valve 102 of full admission, vapor liquid separation is carried out, liquid cooling intermediation comes out of the exterior unit 100, and goes into the liquid piping 122, and is sent to the interior units 200 and 300. The liquid cooling intermediation included in the interior unit 200 is decompressed by the indoor refrigerant flow rate regulating valve 202, and goes into the indoor heat exchanger 201, and heat exchange is carried out to the indoor air sent with the indoor fan 203, and it evaporates. At this time, it is cooled and indoor air blows off from the interior unit 200.

[0022]The refrigerant which evaporated comes out of the interior unit 200. On the other hand, like the above-mentioned interior unit 200, the refrigerant included in the interior unit 300 is decompressed by the indoor refrigerant flow rate regulating valve 302, and goes into the indoor heat exchanger 301, and heat exchange is carried out to the indoor air sent with the indoor fan 303, and it evaporates. At this time, it is cooled and indoor air blows off from the interior unit 300. The refrigerant which evaporated comes out of the interior unit 300, joins the refrigerant which came out from the interior unit 200, passes along the gas piping 121, and is sent to the exterior unit 100. The refrigerant included in the exterior unit 100 is inhaled and compressed into the compressor 105 through the four-way valve 106 and the accumulator 104, and is breathed out again.

[0023]Next, the flow of the refrigerant at the time of heating operation is explained. The dashed line arrow shown in the gas piping 121 and 122 copies of liquid piping expresses a refrigerant flow direction. <> The refrigerant breathed out from the compressor 105 passes along the four-way valve 106, goes into the gas piping 121, and is sent to the interior units 200 and 300. The refrigerant included in the interior unit 200 goes into the indoor heat exchanger 201, and heat exchange is carried out to the indoor air sent with the indoor fan 203, and it is condensed.

Indoor air can warm at this time.

[0024]Then, the condensed refrigerant comes out of the interior unit 200 through the indoor refrigerant flow rate regulating valve 202. On the other hand, the refrigerant included in the interior unit 300 as well as the interior unit 200 is condensed, and comes out of the interior unit 300. The refrigerant which came out of the interior units 200 and 300 joins, and goes into the exterior unit 100 through the liquid piping 122. The refrigerant included in the exterior unit 100 goes into the receiver 107 first, and vapor liquid separation is carried out, Liquid cooling intermediation comes out of the receiver 107, and is decompressed by the indoor refrigerant flow rate regulating valve 102, It goes into the outdoor heat exchanger 101, heat exchange is carried out to the outdoor air sent with the outdoor fan 103, and it evaporates, and through the four-way valve 106 and the accumulator 104, it is inhaled by the compressor 105, it is compressed into it, and is breathed out again.

[0025]Next, operation of the compressor 105 is explained. <> Absorb the outdoor controller 151 with the preset temperature of the room temperature of the interior units 200 and 300, and it computes the request abilities to the compressor 105, and controls the inverter compressor 105a and the 1 constant-speed compressor 105b by a difference with air temperature. The control method is shown in drawing 2 and drawing 3.

[0026]Drawing 2 explains fundamental compressor capacity control. **(1) Operating only with the inverter compressor 105a, when the request abilities to the compressor 105 are small, the drive frequency is lowest frequency.

[0027](2) Lower the drive frequency of the inverter compressor 105a to lowest frequency at the same time it will start operation of the 1 constant-speed compressor 105b, if drive frequency is raised and it goes up to maximum frequency as the request abilities to the compressor 105 become large.

[0028](3) Further, if the request abilities to the compressor 105 become large, the drive frequency of the inverter compressor 105a can be raised again, and it can go up to maximum frequency.

[0029](4) If the drive frequency of the inverter compressor 105a will be decreased if the request abilities to the compressor 105 become small, and it decreases to lowest frequency, the 1 constant-speed compressor 105b will be suspended, and the drive frequency of the inverter compressor 105a will be raised to maximum frequency.

[0030](5) Further, if the request abilities to the compressor 105 become small, the drive frequency of the inverter compressor 105a will be decreased again, and it will lower to lowest frequency.

[0031]Next, the capacity control of the compressor by an embodiment is explained using drawing 3 and drawing 4. A different point from drawing 2 is a time of being the number change of a compressor which a 1 constant-speed compressor turns on and off.

[0032](1) When the request abilities to the compressor 105 are small, the inverter compressor 105a was operated, the 1 constant-speed compressor has stopped, and the drive frequency of the inverter compressor 105a is lowest frequency.
[0033](2) Stop only the time ts which set up the inverter compressor 105a beforehand at the same time it will operate the 1 constant-speed compressor 105b, if drive frequency is raised and it goes up to maximum frequency as the request abilities to the compressor 105 become large.
[0034](3) Operate the inverter compressor 105a with the drive frequency corresponding to the request abilities to the compressor 105 after that.
[0035](4) Further, if the request abilities to the compressor 105 become large, the drive frequency of the inverter compressor 105a will be raised again, and it will go up to maximum frequency.
[0036](5) If the drive frequency of the inverter compressor 105a will be decreased if the request abilities to the compressor 105 become small, and it decreases to lowest frequency, only the time ts which set up the inverter compressor 105a beforehand will be stopped. While the inverter compressor 105a has stopped, it operates only with the 1 constant-speed compressor 105b.
[0037](6) Operate the inverter compressor 105a with the drive frequency corresponding to the request abilities to the compressor 105 at the same time it suspends the 1 constant-speed compressor 105b, after the time ts passes.
[0038](7) Further, if the request abilities to the compressor 105 become small, the drive frequency of the inverter compressor 105a will be decreased again.
[0039]Next, drawing 4 explains. Drawing 4 (a) shows control when the request abilities to the compressor 105 decrease, when the request abilities to the compressor 105 go up in fossete and perform the number change of a compressor.
[0040](1) When the request abilities to the compressor 105 were small, the inverter compressor 105a was operated, the 1 constant-speed compressor has stopped, and the drive frequency of the inverter compressor 105a is lowest frequency.
[0041](2) Suspend the inverter compressor 105a at the same time it will operate the 1 constant-speed compressor 105b, if drive frequency is raised and it goes up to maximum frequency as the request abilities to the compressor 105 become large.
[0042](3) Although the request abilities to the compressor 105 decrease after that, the inverter compressor 105a stops only the time ts set up beforehand, and operate it only with the 1 constant-speed compressor 105b.
[0043](4) Operate the inverter compressor 105a with the drive frequency corresponding to the request abilities to the compressor 105 at the same time it suspends the 1 constant-speed compressor 105b, after the time ts passes.

[0044]Drawing 4 (b) shows control when the request abilities to the compressor 105 go up, when the request abilities to the compressor 105 decrease from size to inside and the number change of a compressor is performed.
[0045](1) Operating the inverter compressor 105a and the 1 constant-speed compressor 105b, when the request abilities to the compressor 105 are large, the drive frequency of the inverter compressor 105a is maximum frequency.
[0046](2) If drive frequency is decreased and it decreases to lowest frequency as the request abilities to the compressor 105 become small, the inverter compressor 105a will be suspended and it will operate only with the 1 constant-speed compressor 105b.
[0047](3) Although the request abilities to the compressor 105 go up after that, the inverter compressor 105a stops only the time ts set up beforehand, and operate it only with the 1 constant-speed compressor 105b.
[0048](4) After the time ts passes, operate the inverter compressor 105a with the drive frequency corresponding to the request abilities to the compressor 105.
[0049]Next, drawing 5 and drawing 6 explain the capacity control of the compressor of other embodiments. The time chart figure and drawing 6 in which the control method of a compressor that drawing 5 is used for the refrigerating cycle of other embodiments is shown are a time chart figure showing the control method of a compressor similarly. A different point from fundamental control of drawing 2 is a time of being the number change of a compressor which a 1 constant-speed compressor turns on and off.
[0050]Drawing 5 explains first. When the request abilities to the compressor 105 are small, the inverter compressor 105a was operated, the 1 constant-speed compressor has stopped, and the drive frequency of the inverter compressor 105a is lowest frequency.
[0051](1) Suspend the inverter compressor 105a at the same time it will operate the 1 constant-speed compressor 105b, if drive frequency is raised and it goes up to maximum frequency as the request abilities to the compressor 105 become large.
[0052](2) A stop of the inverter compressor 105a continues until the command frequency to the inverter compressor 105a becomes large only fs1 from lowest frequency.
[0053](3) When the command frequency to the inverter compressor 105a becomes larger [fs1] than lowest frequency, operate the inverter compressor 105a with the drive frequency of (lowest frequency +fs1).
[0054](4) Further, if the request abilities to the compressor 105 become large, the drive frequency of the inverter compressor 105a will be raised again, and it will go up to maximum frequency.
[0055](5) If the drive frequency of the inverter compressor 105a will be decreased if the request abilities to the compressor 105 become small, and it decreases to lowest frequency, the inverter compressor 105a will stop and will be operated only with the 1 constant-speed

compressor 105b.

[0056](6) A stop of the inverter compressor 105a continues until the command frequency to the inverter compressor 105a becomes small only fs2 from maximum frequency.

[0057](7) Operate the inverter compressor 105a with the drive frequency of (Maximum frequency - fs2) at the same time it suspends the 1 constant-speed compressor 105b, when the command frequency to the inverter compressor 105a becomes smaller [fs2] than maximum frequency.

[0058](8) Further, if the request abilities to the compressor 105 become small, the drive frequency of the inverter compressor 105a will be decreased again.

[0059]Next, drawing 6 explains. Drawing 6 (a) shows control when the request abilities to the compressor 105 decrease, when the request abilities to the compressor 105 go up in fossete and perform the number change of a compressor.

[0060](1) When the request abilities to the compressor 105 were small, the inverter compressor 105a was operated, the 1 constant-speed compressor has stopped, and the drive frequency of the inverter compressor 105a is lowest frequency.

[0061](2) Suspend the inverter compressor 105a at the same time it will operate the 1 constant-speed compressor 105b, if drive frequency is raised and it goes up to maximum frequency as the request abilities to the compressor 105 become large.

[0062](3) Even if the request abilities to the compressor 105 decrease after that, operate the inverter compressor 105a only with the 1 constant-speed compressor 105b, stopped.

[0063](4) A stop of the inverter compressor 105a continues until the command frequency to the inverter compressor 105a becomes small only fs2 from maximum frequency.

[0064](5) Operate the inverter compressor 105a with the drive frequency of (Maximum frequency - fs2) at the same time it suspends the 1 constant-speed compressor 105b, when the command frequency to the inverter compressor 105a becomes smaller [fs2] than maximum frequency.

[0065](6) Further, if the request abilities to the compressor 105 become small, the drive frequency of the inverter compressor 105a will be decreased.

[0066]Drawing 6 (b) shows control when the request abilities to the compressor 105 go up, when the request abilities to the compressor 105 decrease from size to inside and the number change of a compressor is performed.

[0067](1) Operating both the inverter compressor 105a and the 1 constant-speed compressor 105b, when the request abilities to the compressor 105 are large, the drive frequency of the inverter compressor 105a is maximum frequency.

[0068](2) If drive frequency is decreased and it decreases to lowest frequency as the request abilities to the compressor 105 become small, the inverter compressor 105a will be suspended and it will operate only with the 1 constant-speed compressor 105b.

[0069](3) Even if the request abilities to the compressor 105 go up after that, operate the inverter compressor 105a only with the 1 constant-speed compressor 105b, stopped.
[0070](4) The command frequency to the inverter compressor 105a continues a stop of the inverter compressor 105a until only fs1 becomes large from lowest frequency.
[0071](5) When the command frequency to the inverter compressor 105a becomes larger [fs1] than lowest frequency, operate the inverter compressor 105a with the drive frequency of (lowest frequency +fs1).
[0072](6) Further, if the request abilities to the compressor 105 become large, the drive frequency of the inverter compressor 105a will be raised.
[0073]
[Effect of the Invention]According to this invention, the operation time of an inverter drive compressor is decreased, the failure rate of an inverter drive compressor is reduced in connection with it, and a reliable refrigerating cycle is provided. Since a stop of an inverter drive compressor is performed when there are few rates that an inverter drive compressor occupies in the request abilities to a compressor, influence which it has on load can also be lessened.
[0074]The refrigerating cycle by this invention can decrease the operation time of an inverter drive compressor, even when a load change is large, it can control the frequent deactivation of an inverter drive compressor, and can reduce a failure rate.

[Translation done.]